CLAIMS

1. An air-fuel ratio control apparatus for an internal combustion engine of a vehicle, the air-fuel ratio control apparatus comprising:

an air-fuel ratio sensor located upstream of a three-way catalyst in an exhaust system of the internal combustion engine, wherein the air-fuel ratio sensor detects an engine air-fuel ratio based on a concentration of oxygen in exhaust gas; and

an oxygen sensor located downstream of the three-way catalyst, wherein the oxygen sensor detects the engine air-fuel ratio based on the concentration of oxygen in exhaust gas,

wherein the control apparatus:

performs feedback control of an amount of fuel based on output of the air-fuel ratio sensor such that the engine air-fuel ratio seeks a stoichiometric air-fuel ratio;

performs sub-feedback control by computing a sub-feedback correction value based on output of the oxygen sensor, wherein the sub-feedback correction value corrects the fuel amount in the feedback control;

learns a learning value based on the sub-feedback correction value, wherein the learning value is used for compensating for a stationary difference between the stoichiometric air-fuel ratio and the engine air-fuel ratio, which stationary difference is based on output characteristics of the air-fuel ratio sensor;

stores the learning value;

executes fuel cutoff control in a predetermined period; and

inhibits the fuel cutoff control until the learning is stabilized when learning of the stored learning value is performed after the stored learning value is cleared.

2. The air-fuel ratio control apparatus according to claim 1, further comprising a fluid power transmission having a lockup clutch, wherein the lockup clutch couples the internal combustion engine and an automatic transmission to each other, wherein, during deceleration of the vehicle, the air-fuel ratio control apparatus causes the lockup clutch to operate in a slipping state, and wherein, when learning of the learning value is performed after the stored learning value is cleared, the air-fuel ratio control apparatus inhibits the lockup clutch from operating in a slipping state until the learning is stabilized.

3. The air-fuel ratio control apparatus according to claim 1, wherein, when learning of the learning value is performed after the stored learning value is cleared, the air-fuel ration control apparatus changes a feedback gain, which is used for computing the sub-feedback correction value, to a value that is greater than a value of the feedback gain used after the learning is stabilized.

4. The air-fuel ratio control apparatus according to claim 1, wherein, when learning of the learning value is performed after the stored learning value is cleared, the air-fuel ratio control apparatus relaxes a limit value of the sub-feedback correction value compared to a limit value used after the learning is stabilized.

5. The air-fuel ratio control apparatus according to claim 1, wherein, when learning of the learning value is performed after the stored learning value is cleared, the air-fuel ratio control apparatus determines that the learning is stabilized based on that the number of times of output reversal of the oxygen sensor reaches a predetermined number of times during the sub-feedback control.

6. The air-fuel ratio control apparatus according to claim 1, wherein, when learning of the learning value is performed after the stored learning value is cleared, the air-fuel ratio control apparatus determines that the learning is stabilized based on that a predetermined period has elapsed from the start of the sub-feedback control.

7. The air-fuel ratio control apparatus according to claim 1, wherein, when learning of the learning value is performed after the stored learning value is cleared, the air-fuel ratio control apparatus changes the absolute value of a feedback gain, which is used for computing the sub-feedback correction value, or the absolute value of a limit of the sub-feedback correction value to a value that is greater than a value of the feedback gain or the feedback correction value limit used after the learning is stabilized.

8. The air-fuel ratio control apparatus according to claim 7, wherein the air-fuel ratio sensor detects the air-fuel ratio based on the concentration of oxygen in exhaust gas and outputs an output voltage that is linearly varied according to the air-fuel ratio.